11-2014

Government Spending and Inclusive Growth in Developing Asia

Seok-Kyun Hur
Asian Development Bank

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Abstract

This paper assesses the effects of fiscal policy on both equity and growth, specifically whether it is possible to design fiscal spending so that it enhances equity without sacrificing economic growth and vice versa. A cross-country panel vector autoregression (PVAR) using the World Development Indicators confirms the growth effects of individual fiscal spending items as anticipated whereas distributional effects were either temporarily positive or negligible for most fiscal items. However, compared with Organisation for Economic Co-operation and Development members, spending on public health and public education appeared to alleviate income inequality significantly in the Asian Development Bank members. This implies that fiscal expenditure policies may contribute more to inclusive growth in developing economies than in advanced ones.

Keywords

Gini coefficient, government spending, inclusive growth, Panel Vector Autoregression

Comments

Suggested Citation

Hur, S. (2014). *Government spending and inclusive growth in developing Asia*. Manila: Asian Development Bank.

GOVERNMENT SPENDING AND INCLUSIVE GROWTH IN DEVELOPING ASIA

Seok-Kyun Hur

NO. 415

November 2014

ADB ECONOMICS WORKING PAPER SERIES

ASIAN DEVELOPMENT BANK

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ADB Economics Working Paper Series

Government Spending and Inclusive Growth in Developing Asia

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No. 415 | 2014

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ASIAN DEVELOPMENT BANK

Asian Development Bank
6 ADB Avenue, Mandaluyong City
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www.adb.org

November 2014
ISSN 2313-6537 (Print), 2313-6545 (e-ISSN)
Publication Stock No. WPS 146932-3

Note: In this publication, "$" refers to US dollars.

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ABSTRACT

This paper assesses the effects of fiscal policy on both equity and growth, specifically whether it is possible to design fiscal spending so that it enhances equity without sacrificing economic growth and vice versa. A cross-country panel vector autoregression (PVAR) using the World Development Indicators confirms the growth effects of individual fiscal spending items as anticipated whereas distributional effects were either temporarily positive or negligible for most fiscal items. However, compared with Organisation for Economic Co-operation and Development members, spending on public health and public education appeared to alleviate income inequality significantly in the Asian Development Bank members. This implies that fiscal expenditure policies may contribute more to inclusive growth in developing economies than in advanced ones.

Keywords: Gini coefficient, government spending, inclusive growth, Panel Vector Autoregression

JEL Classification: E62, H50

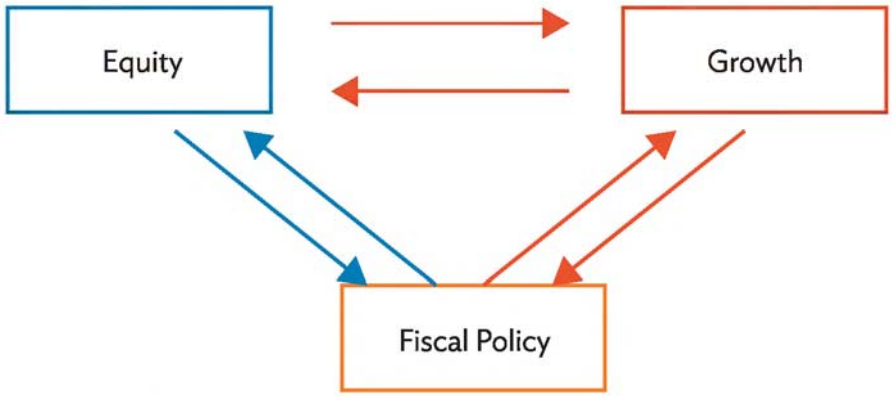
I. INTRODUCTION

Inclusive growth refers to long-term, sustained economic growth that is broad based and includes a large part of the labor force, thereby reducing unemployment and income inequality significantly. Policies that encourage inclusive growth tend to emphasize removing constraints to growth, creating opportunities, and creating equal treatment for investment. Ranieri and Ramos (2013) compare various definitions of inclusive growth and demonstrate that there is no standard one, though there is a certain consensus. According to Rauniyar and Kanbur (2010), "Inclusive growth is that which is accompanied by lower income inequality, so that the increment of income accrues disproportionately to those with lower incomes." This paper follows that definition and explores how government spending can better serve the goal of inclusive growth.

Compared with revenue policies, spending programs are more likely to have direct effects on specific groups. For example, social transfers and the free or subsidized provision of public services are often directed to low-income families. In this sense, it would be meaningful to discuss whether and/or how government expenditures contribute to economic growth while alleviating income inequality and maintaining social cohesion.

Figure 1 identifies the three key variables in this paper and their relationships; confirming or refuting any of the arrows would be a worthy research endeavor. Actually, many studies have dealt with one or more of the arrows, and one very popular debate issue is how equity and economic growth are linked to each other (the two arrows at the top). Some economists claim there is a tradeoff between the two while others favor co-movement. In addition, there are studies that examine the causality between equity and growth, but in my opinion, there is no dominant theory as arguments that are supported in one theory are refuted by changing the empirical evidence.

Figure 1: Three Key Variables and Their Links



Source: Author.

For example, in his seminal paper, Kuznets (1955) argued that there was an inverted U-shaped relationship between the Gini coefficient and economic growth, and the resulting Kuznets curve is well supported by data from western European and Latin countries. On the other hand, it is also known that extending the data set to include more economies, especially those in East Asia, weakens the validity of the curve. Acemoglu and Robinson (2002) point out that the discrepancy between the so-called "East

Asian miracles" and the Kuznets curve may be reconciled by introducing political factors and redistributive mechanisms through political competition.

Recently, Berg and Ostry (2011) reported that the trade-off between efficiency and equality may not exist in the long run. They provide empirical findings that greater inequality may shorten the duration of growth. However, they are very cautious about suggesting a policy recommendation because poorly designed efforts to reduce inequality could be counterproductive.

Various empirical results on the relationship between growth and equity have been reported using different scopes and time-series data. Those results are sometimes consistent and conflicting, and have been interpreted by emphasizing specific policy or transmission channels. Regardless of such differences, however, the existing literature seems to reach a minimal consensus that equity and economic growth closely interact with each other.

Another avenue of research is to explore the effectiveness of fiscal policy as a countercyclical measure and/or to examine the responsiveness of fiscal policy to business cycle fluctuations. The two arrows at the right in Figure 1 represent this research. Studies in this area do not reach unanimous decisions. Recently, Jha et al. (2010) estimated the fiscal multipliers for tax cuts and spending expansion for 10 Asian economies using the sign restriction estimations of Mountford and Uhlig (2002). They reported that tax cuts tend to have greater and more persistent growth effects than spending increases which, however, may not be valid for economies in other areas. It is not so surprising considering that governments have different fiscal management systems and different mind sets in policymaking, not to mention different national priorities.

Though results diverge from one economy to another or by period, most of the research in this area adopts a structural vector autoregression (SVAR) setup. According to de Castro and Hernandez de Cos (2006), the literature using SVAR can be categorized into the four groups listed in Table 1 by differences in fiscal shock identification strategies.[1]

Table 1: Relevant Literature Using Structural Vector Autoregression

Literature	Shock Identification Strategy
Ramey and Shapiro (1998); Edelberg, Eichenbaum, and Fisher (1999)	Vector autoregression (VAR) models with dummy variables specifying certain episodes (such as wars and drastic changes in fiscal stance)
Mountford and Uhlig (2002)	VAR with sign restrictions on the impulse response functions
Fatas and Mihov (2000), Favero (2002), de Castro (2004)	Structural vector autoregression (SVAR) (Cholesky Decomposition)
Blanchard and Perotti (2002), Perotti (1999), Hoppner (2002)[a]	SVAR using institutional information and quarter dependence

[a] Hoppner (2002), following the shock representation by Blanchard and Perotti (2002), concentrates on distinguishing the direct effects of fiscal shock from the indirect effects of automatic stabilization mechanisms.

Source: Hur 2007.

[1] Perotti (2004) classifies SVAR literature into three groups. De Castro and Hernandez de Cos (2006) add an additional group that includes Blanchard and Perotti (2002) and Perotti (2004).

The popularity of SVAR lies in that it is less dependent on existing economic theory and is less susceptible to endogeneity and co-integration[2] among the variables of interest. Using SVAR is, however, more challenging for analyzing fiscal policy than for analyzing monetary policy for several reasons, such as the existence of uncertain or unidentifiable policy lags and automatic stabilization mechanisms. These factors combined with the low frequency of fiscal data (mostly quarterly) cause technical difficulties in identifying sources of correlations or causalities among the disturbances of the vector autoregression (VAR) system and disentangling the contributions of built-in stabilization mechanisms. Recent developments in analyzing fiscal policy using VAR naturally have concentrated on dealing with these problems.

In estimating SVAR, it is crucial to track down the fiscal stance and see how it varies in a business cycle. Fiscal policy could influence the dynamics of an economy through automatic stabilizers as well as through discretionary measures. Thus, we need to separate the portion contributed by each. Though conceptually clear, it is quite intriguing to empirically decompose changes in fiscal variables into these two categories. It also explains why shock identification is critical in estimating SVAR, as shown in Table 1.

In policy circles, fiscal impulse and fiscal stance indicators are commonly used as proxies for discretionary fiscal policies (see Heller, Haas, and Mansur 1986). With these indicators, the interaction between fiscal stance and the business cycle can be approached more simply than using SVAR. The time series of fiscal impulse and/or fiscal stance in a business cycle can be assessed jointly with that of real gross domestic product (GDP) growth in terms of efficacy and timing. Obviously, VAR is not the only option; many studies have adopted a single equation approach linking real GDP growth and fiscal variables with other control variables. Fiscal impulse and fiscal stance are variables frequently used in the single equation approach.

Still another avenue of research is to assess the distribution effects of fiscal policy (the two arrows at the left in Figure 1). Compared with the other two avenues, this one is relatively new. In the most recent study,[3] Ball et al. (2013) estimated the distributional effects of fiscal consolidation. Using a sample of 17 Organisation for Economic Co-operation and Development (OECD) members, they showed that fiscal consolidation increases inequality. They also showed that spending-based adjustments tend to have greater distributional impacts than tax-based adjustments. Woo et al. (2013) also focused on the effects of fiscal consolidation and/or fiscal policy on equity, and reported qualitatively the same results as Ball et al. Using a larger data set, Woo et al. (2013) estimated equations with variables representing several fiscal items and reported that progressive taxation and targeted social benefits and subsidies reduced income inequality. Many other studies on the same issue provide empirical findings that some spending items (such as transfers and welfare, education, health, and housing) tend to have greater effects on reducing income inequality than other spending items or even specific taxes (Martinez-Vazquez, Moreno-Dodson, and Vulovic 2012; Joumard, Pisu, and Bloch 2012; Cubero and Hollar 2010).

This paper distinguishes itself from the existing literature in that it examines the effects of fiscal policy on both equity and growth,[4] specifically whether it is possible to design fiscal spending so that it

---

[2] Even when co-integrated relations exist among key variables, the use of basic VAR can be still advocated on the grounds that the parameters are estimated consistently and the estimates have the same asymptotic distribution as those of differenced data (Hamilton 1994).

[3] Refer to Woo et al. (2013) for other studies on similar topics.

[4] "One reasonably firm conclusion is that it would be a big mistake to separate analyses of growth and income distribution." Berg and Ostry (2011).

enhances equity without sacrificing economic growth and vice versa. Generally, it is agreed that greater spending on health, education, and public infrastructure, as long as it is efficiently administered, is key to a more inclusive growth. A well-known survey by Lopez (2004) on economic growth concludes that macroeconomic stability, low inflation rates, and appropriate education and infrastructure-related policies have positive effects on growth and reduce inequality. Hence, fiscal policy is not the only policy vehicle to rely on, but undoubtedly, it is a crucial one. In this context, this paper examines the contribution of fiscal expenditure to sustaining an inclusive growth path. Keeping in mind that poorly designed efforts to reduce inequality could be counterproductive (Berg and Ostry 2011), I decompose fiscal spending into several subgroups and evaluate their relative contributions to inclusive growth.

II. DATA AND KEY VARIABLES

As mentioned previously, this paper analyzes the effects of fiscal policy on both equity and growth. For that purpose, I composed a cross-country panel by combining data from the Standardized World Income Inequality Database (SWIID) and the World Bank's World Development Indicators (WDI). I specifically chose SWIID for an inequality measure because the data set provided by Solt (2014) is better than the Luxembourg Income Study and the World Income Inequality Database in terms of coverage and quality.

A. Key Variables

Government spending (expense) was classified into the following subgroups from WDI; each was converted to a percentage of GDP:[5]

- Government final consumption expenditure;[6]
- Gross capital formation, public;
- Health expenditure, public;
- Military expenditure;
- Social transfer and subsidy; and
- Public spending on education.

Next, two Gini coefficients—Gini_net and Gini_market (Gini_gross)—were gathered from SWIID. Gini_net is a coefficient calculated after subtracting taxation and adding public transfers, while Gini_market uses income before taxation and transfers. For this study, I used the Gini_market coefficients because it would be more interesting to examine the distributional and growth effects of fiscal spending, excluding direct and contemporaneous effects. For example, some fiscal items, such as social subsidies, transfers, and progressive income tax, tend to have direct distributional effects by construction. The difference between Gini_market and Gini_net is mainly explained by the direct influences of those fiscal items.

In addition, the following variables were collected from WDI, some of which were used as control variables if necessary:

---

[5] The proportion is easily converted to a percent of expense if multiplied by expense (percent of GDP).

[6] According to the World Bank, "General government final consumption expenditure (formerly general government consumption) includes all government current expenditures for purchases of goods and services (including compensation of employees). It also includes most expenditures on national defense and security, but excludes government military expenditures that are part of government capital formation."

- Real GDP growth;
- Revenue (% of GDP);
- Tax revenue (% of GDP);
- Taxes on income, profits, and capital gains (% of GDP);
- Social contributions (% of GDP);
- Literacy rate;
- Labor force with primary (secondary or tertiary) education;
- Unemployment rate;
- Labor force with primary (secondary or tertiary) education;
- Market capitalization (% of GDP);
- Standard & Poor's Global Equity Indices (annual % change);
- Life expectancy at birth, total (years);
- Cash surplus/deficit (% of GDP);
- Central government debt, total (% of GDP); and
- Poverty gap at the national poverty line (%).[7]

Table 2 provides the abbreviations and definitions for these variables.

Table 2: Definitions and Abbreviations for Key Variables

Abbreviations	Definitions
cap_exp	Gross fixed capital formation, public (% of GDP)
edu_exp	Public spending on education (% of GDP)
expense	Expense (% of GDP)
fiscal_debt	Central government debt, total (% of GDP)
fiscal_surplus	Cash surplus/deficit (% of GDP)
gfce	Government final consumption expenditures (% of GDP)
gini_diff	Difference between the two Gini coefficients (gini_gross–gini_net)
gini_gross	Gini before taxation and transfers
gini_net	Gini after taxation and transfers
global_equity_index	S&P Global Equity Indices (annual % change)

continued on next page

[7] "Poverty gap at the national poverty line" is the mean shortfall from the poverty line (counting the nonpoor as having zero shortfall) as a percentage of the poverty line. This measure reflects the depth of poverty as well as its incidence.

Table 2 continued

Abbreviations	Definitions
health_exp	Health expenditure, public (% of GDP)
income_tax	Taxes on income, profits, and capital gains (% of GDP)
life_exp	Life expectancy at birth, total (years)
literacy	Literacy rate, adult total (% of population aged 15 and above)
market_cap	Market capitalization (% of GDP)
mil_exp	Military expenditure (% of GDP)
poverty_gap	Poverty gap at national poverty line (%)
primary_edu	Labor force with primary education (% of total population aged 15–64)
r_gdp_growth	Real GDP growth
revenue	Revenue excluding grants (% of GDP)
secondary_edu	Labor force with secondary education (% of total population aged 15–64)
social_contribution	Social contributions (% of GDP)
tax_revenue	Tax revenue (% of GDP)
tertiary_edu	Labor force with tertiary education (% of total population aged 15–64)
transfer_exp	Subsidies and other transfers (% of GDP)
unemployment	Unemployment, total (%)

GDP = gross domestic product, S&P = Standard and Poor's.
Source: Author.

B. Coverage

The data set covers 34 OECD members and 33 out of 48 Asian Development Bank (ADB) regional members (the 15 missing are Afghanistan; Brunei Darussalam; the Cook Islands; Kiribati; the Marshall Islands; the Federated States of Micronesia; Myanmar; Nauru; Palau; Samoa; Solomon Islands; Taipei,China; Tonga; Tuvalu; and Vanuatu) for a total of 63 economies in the panel data. Of the four that overlap the two groups, Australia, Japan, and New Zealand are treated as part of the OECD group, while the Republic of Korea is in the ADB group.

In WDI, there are approximately 100 countries that are neither the OECD nor ADB regional members; the observations for them are also used if necessary.[8] All the economies in the data set are classified into one of five income groups based on per capita GDP (constant $2005) in 2010. Income group 1 has a per capita income of less than $1,000; group 2 is between $1,000 and $5,000; group 3 is between $5,000 and $10,000; group 4 is between $10,000 and $20,000; and group 5 is more than $20,000.

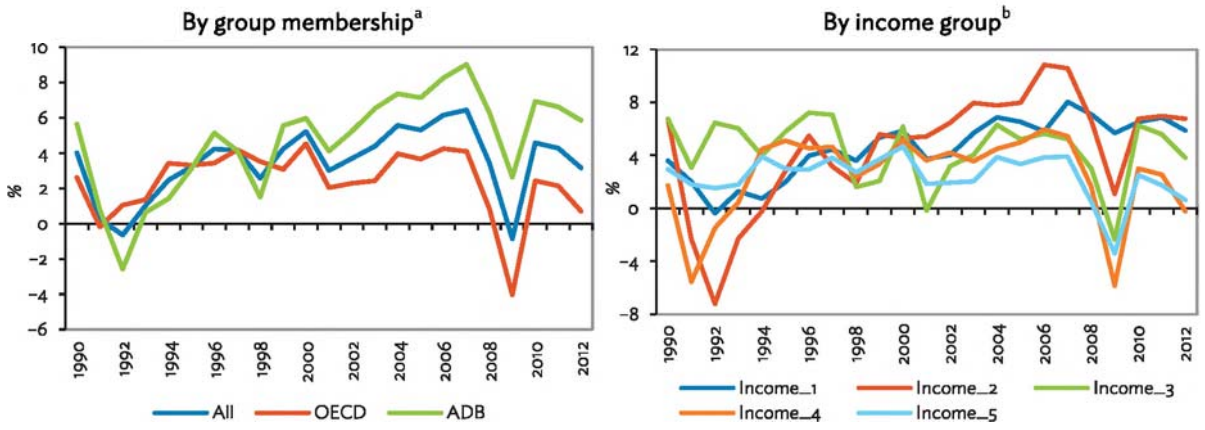
[8] I use the whole-country WDI data in tables 5–11 and in Table 14 to prevent the loss of observations due to the inclusion of control variables. Other than in these tables, results from the PVAR are based on the data set covering the OECD and ADB members.

C. Summary Statistics

Summary statistics of the key variables are reported in the Appendix. Separate tables are provided depending on membership in ADB or the OECD, or on income group. The following anticipated patterns can be noted.

1. **The real GDP growth rate is lower for high-income economies.** The higher growth momentum in developing economies is consistent with the so-called beta convergence theory. The first graph in Figure 2 confirms that such a phenomenon has been consistently observed over time between the OECD and ADB members, with the exception of the 1997 Asian financial crisis. On the other hand, the second graph shows that economies in income groups 2 or 3 tend to have higher growth rates than those in the other income groups, indicating that catching up may begin in those growth stages.

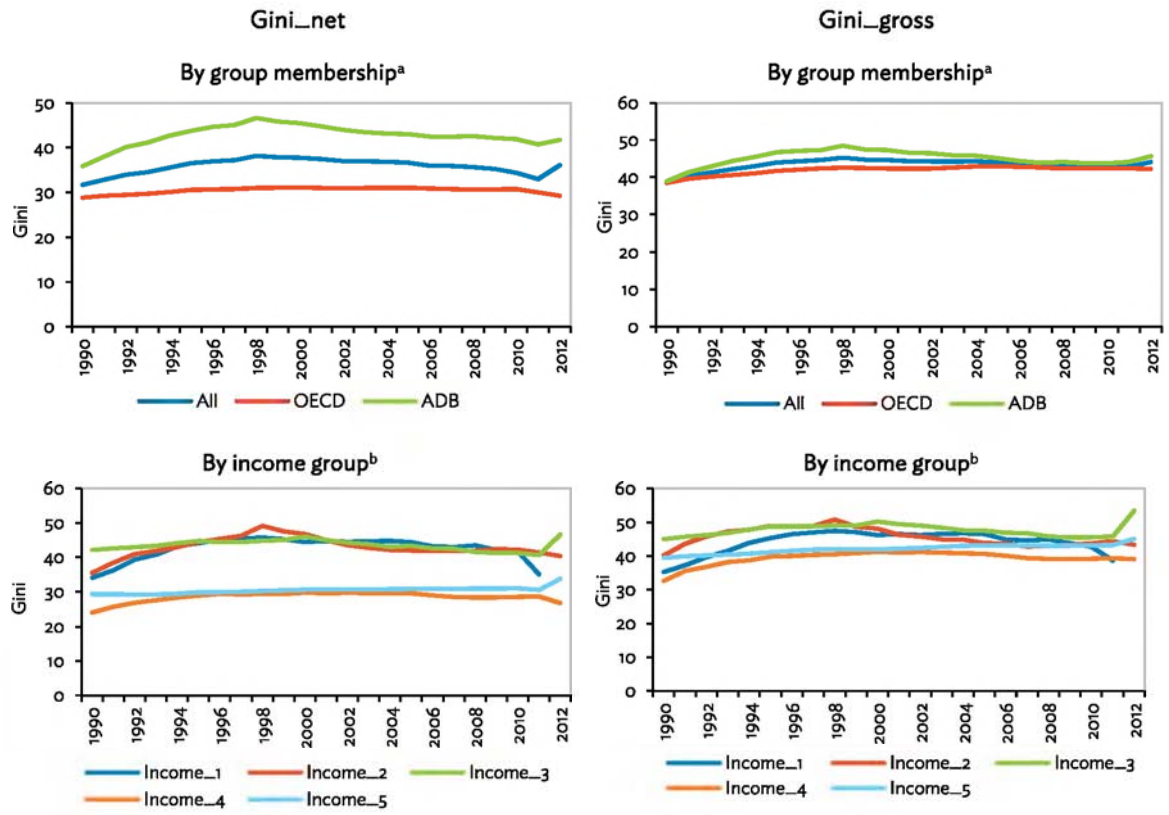
Figure 2: Time Trends of Real Gross Domestic Product Growth Rates



ADB = Asian Development Bank, OECD = Organisation for Economic Co-operation and Development.
[a] ADB covers 33 of its 48 members, while the OECD has its 34 members.
[b] Income group 1 has a per capita income less than $1,000; group 2 is between $1,000 and $5,000; group 3 is between $5,000 and $10,000; group 4 is between $10,000 and $20,000; and group 5 is more than $20,000.
Source: Author's estimates.

2. **Both Gini coefficients are higher in developing economies.** Figure 3 confirms that the Gini coefficients are higher in developing economies, with a few exceptions. Furthermore, the differences between ADB and the OECD members, or between income groups 1 and 3, and 4 and 5, are magnified for the Gini_net coefficients. As expected, fiscal policy in developed economies puts more emphasis on redistribution.

Figure 3: Time Trends of Gini Coefficients



ADB = Asian Development Bank, Gini_gross = Gini coefficient before taxation and transfers, Gini_net = Gini coefficient after taxation and transfers, OECD = Organisation for Economic Co-operation and Development.

[a] ADB covers 33 of its 48 members, while the OECD has its 34 members.

[b] Income group 1 has a per capita income less than $1,000; group 2 is between $1,000 and $5,000; group 3 is between $5,000 and $10,000; group 4 is between $10,000 and $20,000; and group 5 is more than $20,000.

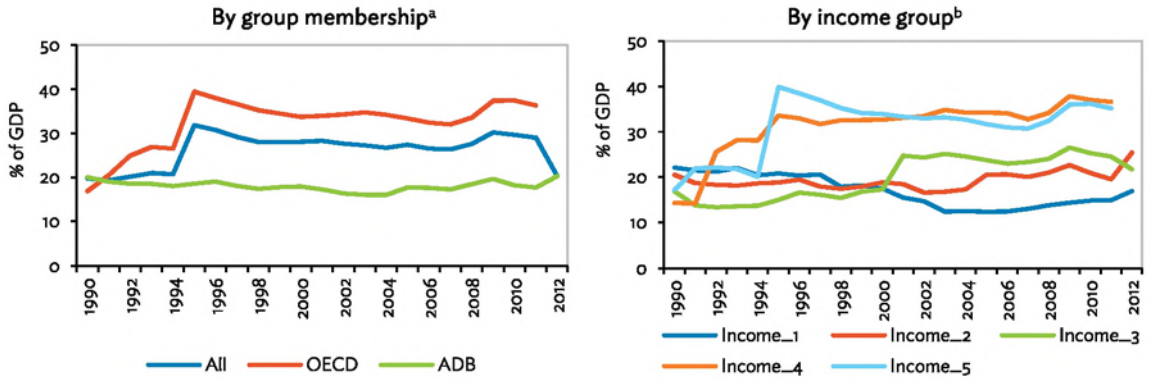
Source: Author's estimates.

Another notable point is that the Gini coefficients cannot be ordered by income groups. For example, in the Gini_gross graphs in Figure 3, the income inequalities in income group 3 are greater than or almost equal to those of income group 1. Though consistent with the traditional Kuznets curve, the pattern still needs further explanation.

3. **Government spending takes a smaller fraction of GDP in developing economies, and the percent of GDP (expense) is also smaller** (Figure 4). The pattern is the same with the ratio of government final consumption expenditures to GDP. It indicates that developing economies are likely to hold more fiscal capacity than developed ones. The recent global financial crisis made people aware of how critical it is to maintain room for fiscal expansion in difficult times. Furthermore, in the next 2 decades, most developing economies are expected to experience demographic aging, which will also be a heavy fiscal burden. On the other hand, this also implies that governments in developing economies may provide fewer public services than those in developed ones and/or may do less redistributing.

4. **With the exception of gross fixed capital formation (public, % of GDP), the ratios of all the other fiscal items to GDP are smaller in developing economies.** Since 2000, the average ratio of gross fixed capital formation (public) to GDP in ADB members has been 7.7, which is much higher than the 4.3 for the OECD members. Developing economies tend to allocate their limited fiscal resources intensively to building social overhead capital, which supports economic activities in the private sector and improves quality of life. This is reflected in the high proportion of government final consumption expenditures to GDP in Asian economies.

Figure 4: Time Trends of Expense



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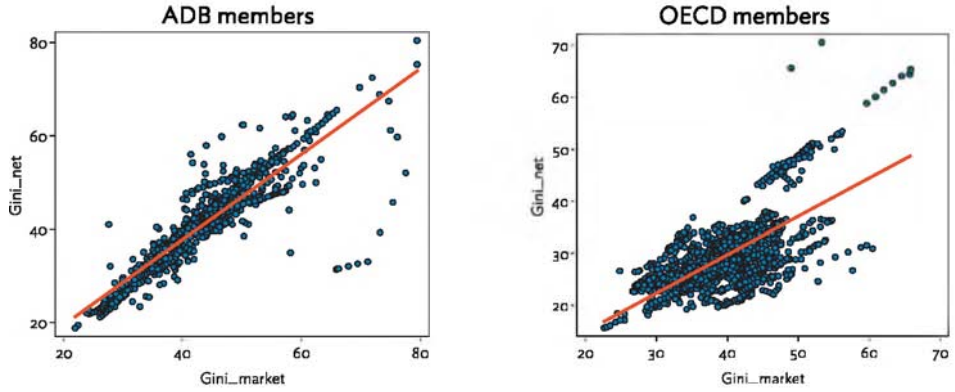
Source: Author's estimates.

5. **The role of fiscal policy in redistribution is emphasized in developed economies.** Figure 5 provides scatter plots between the Gini_gross (Gini_market) and the Gini_net coefficients and demonstrates how close the fitted line between the two is to 45 degrees. Compared with ADB members, the Gini_net coefficients of the OECD members tend to lie below the 45-degree line with respect to the Gini_gross coefficients. These two figures confirm the conjecture that developed economies pay more attention to redistribution.

Figure 5: Relationship between Gini_Net and Gini_Market Coefficients



ADB = Asian Development Bank, OECD = Organisation for Economic Co-operation and Development.
Source: Author's estimates.

III. EMPIRICAL STRATEGIES

This paper focuses on estimating the effects of spending composition on both equity and economic growth. I used mainly PVAR for calculations in light of the close interaction among these three key variables as well as the panel structure of the data set. Compared with VAR, PVAR has the relative advantage in that it can complement short-time coverage with more cross-section samples. The time coverage differs from one economy to another in the data set, so PVAR was used. As a complement, the results from single equation estimations are also provided.

A. Panel Vector Autoregression

The PVAR estimates the interactions among the growth rate, the Gini coefficient, and fiscal variables, and includes four variables. With the GDP growth rate and the Gini coefficient fixed, government expense (spending) and a selected component of the expense are included.

In a four-variable PVAR, a change in one individual fiscal spending item can influence the other variables through two separate channels—first, by changes in gross spending (magnitude effect) and second, by changes in the composition of spending (composition effect). In contrast with the magnitude effect, the composition effect is based on substituting different fiscal items. In other words, increasing the share of a fiscal expenditure item can be done only by decreasing the shares of others. The four-variable PVAR was adopted to separate the two effects.

All the fiscal variables are measured as a percentage of GDP. By including expense and its component together, we can compare the effects on the two fiscal variables and assess whether a change in the fiscal spending component has a bigger impact on economic growth and the Gini coefficient than the other spending component.

The PVAR is specified as follows.

$$X_{it} = A(L)X_{it} + f_i + \varepsilon_{it},\ i = \text{country},\ t = \text{year},\ f_i = \text{fixed effects}$$

$$X_{it} \equiv \begin{bmatrix} growth_{it} \\ \Delta gini_{it} \\ \Delta B_{it} \end{bmatrix} \tag{1}$$

In (1), B_{it} is a vector or a scalar of the fiscal items covering all types of expenditures, tax revenues, and fiscal balance (deficit or surplus). All these numbers are counted as a percentage of GDP. Considering that the length of the time series may vary from one economy to another, I did not consider the case that the dimension of the vector X_{it} is greater than 5. Maintaining the dimension of PVAR below 5 is acceptable in the following sense.

$$\sum_{j=1}^{n} \Delta B_{it}^{j} = 0, B_{it} \equiv (B_{it}^{1}, B_{it}^{2}, \ldots, B_{it}^{j}, \ldots, B_{it}^{n}) \tag{2}$$

In (2), the superscript j classifies fiscal expenditure, tax revenues, and fiscal deficit (or surplus) into smaller groups. Their sum should be equal to zero by construction. Hence, equation (1) using n-itemized fiscal variables combined with this restriction can always be transformed into a new equation with (n-1) fiscal variables (Kneller, Bleaney, and Gemmell 1999).

$$X^*_{it} = A^*(L)X^*_{it} + f_i + \varepsilon_{it},\ i = \textit{country},\ t = \textit{year}$$
$$X_{it} \equiv \begin{bmatrix} growth_{it} \\ \Delta gini_{it} \\ \Delta E_{it} \end{bmatrix} \tag{3}$$

In (3), E_{it} is a vector or a scalar of itemized government spending and the dimension of E_{it} is smaller than B_{it} by 1. Of course, the coefficients should be differently interpreted in consideration of substitutions. In other words, $A(L) \neq A^*(L)$.

Estimating (3) and drawing impulse response functions was done using the Stata code of Love and Zicchino (2006). Gini coefficients and fiscal variables are differenced in order to control for non-stationarity. Lags of 4 were given and shocks were assumed to occur in the order of real GDP growth, Gini coefficient, and fiscal spending.[9] It was also assumed that a contemporaneous shock would affect expense first and would later affect an individual component of expense. This ordering is consistent with the prior belief that fiscal policy is responsive to the state of the economy.

B. The Single Equation Approach

Depending on the utilization of the panel structure of the data, the single equation approach can use either ordinary least squares (OLS) or panel regression. In this study, OLS measure how government spending influences (i) GDP growth and (ii) the Gini coefficient while controlled by other socioeconomic variables. The free use of control variables especially distinguishes this approach from PVAR. OLS will take the form of either (4) or (5).

$$growth_{it} = \gamma_1 E_{it-1} + \textstyle\sum_{k=1}^{m} \beta_k Z_{it}{}^{k} + \varepsilon^1_{it}, \tag{4}$$
$$gini_{it} = \gamma_2 E_{it-1} + \textstyle\sum_{k=1}^{m} \alpha_k Z^k_{it} + \varepsilon^2_{it},\ i = \textit{country},\ t = \textit{year}$$

$$growth_{it} = \gamma_1 E_{it} + \textstyle\sum_{k=1}^{m} \beta_k Z_{it}{}^{k} + \delta D_i + \varepsilon^1_{it}, \tag{5}$$
$$gini_{it} = \gamma_2 E_{it} + \textstyle\sum_{k=1}^{m} \alpha_k Z^k_{it} + \delta D_i + \varepsilon^2_{it},\ i = \textit{country},\ t = \textit{year}$$

In the above, D_i is a dummy variable representing income group or membership in ADB or the OECD.

In the panel regression, allowing fixed heterogeneity among economies (f_i), I estimated the following equations one by one. Furthermore, lagged dependent variables were used for explanatory ones. Only lagged fiscal variables (E_{it-1}) as well as control variables (Z^k_{it}) were used as regressors. Therefore, the estimation required the use of instrumental variables, and the equations in (6) are estimated by the Arellano and Bond (1991) method.

$$growth_{it} = \beta_1(L)\, growth_{it-1} + \gamma_1 E_{it-1} + \textstyle\sum_{k=3}^{m+2} \beta_k Z_{it}{}^{k} + f_i + \varepsilon^1_{it}, \tag{6}$$
$$gini_{it} = \alpha_1(L) gini_{it-1} + \gamma_2 E_{it-1} + \textstyle\sum_{k=3}^{m+2} \alpha_k Z^k_{it} + f_i + \varepsilon^2_{it},\ i = \textit{country},\ t = \textit{year}$$

[9] Sometimes results from VAR estimations are quite sensitive to shock ordering. Luckily, however, this PVAR seems robust with respect to different orders.

IV. RESULTS

This section presents results from estimating (3)–(6) in the following order. To begin with, results from PVAR are provided in the form of impulse response functions (IRFs). Next, the results from OLS and the panel regression are shown in tables. Finally, long-term correlations of various fiscal expenditure items are reported with the GDP growth rate and the Gini coefficient.

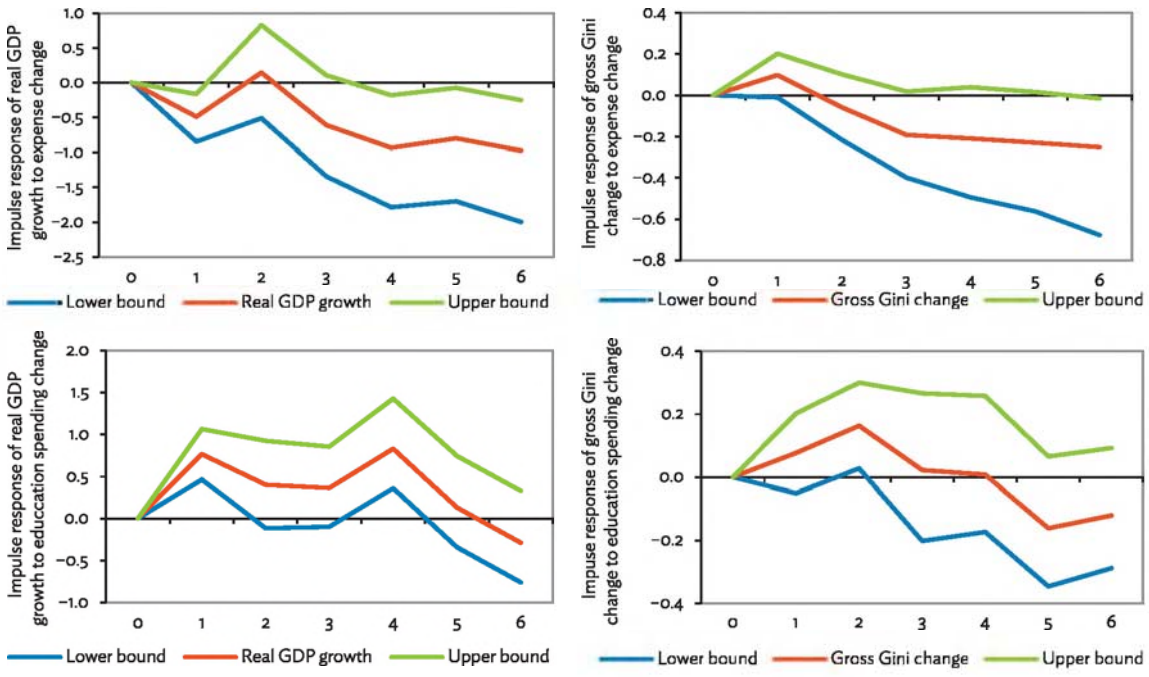
A. Results from Panel Vector Autoregression

The IRFs are drawn and interpreted in this section. Each of them is generated by Monte Carlo simulations with 500 repetitions. Areas between the upper and lower lines have a 90% confidence interval for IRFs over the next 6 years.

1. Estimation of the Whole Sample

The four-variable PVARs consist of government expense and a selected component of the expense as well as Gini_gross and real GDP growth.[10] First, Figure 6 draws the IRFs for expense and public spending on education. As for economic growth, public education spending is expected to have persistent and positive effects on GDP growth, whereas the effect of expense is insignificant. On the other hand, increases in the two spending items are likely to raise the Gini coefficient temporarily. The negative effect of education spending on income inequality is almost negligible.

Figure 6: Four-Variable Panel Vector Autoregression for Changes in Expense and Public Education Spending

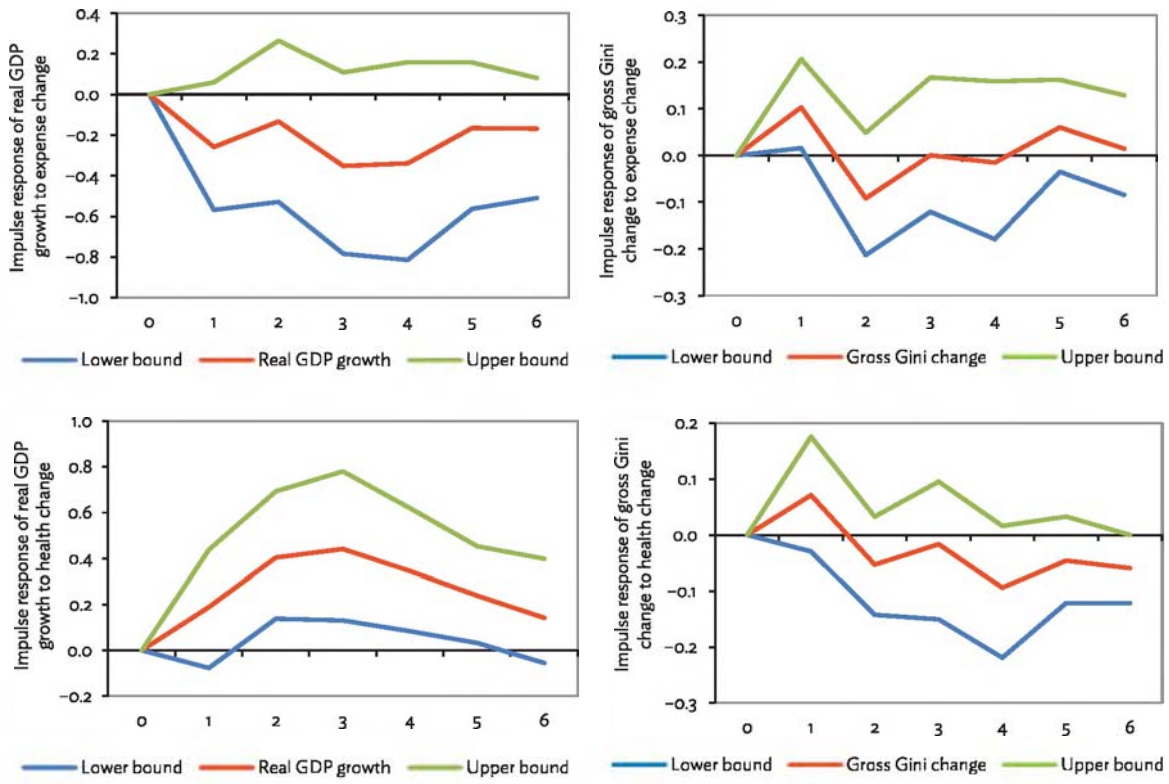


GDP = gross domestic product, gross Gini change = change in Gini before taxation and transfers.
Source: Author's estimates.

[10] Of the four variables, three are used in differences. Real GDP growth is not.

Second, Figure 7 draws the IRFs for expense and public health spending. The results are qualitatively the same as the three-variable PVAR. Hence, public health spending is likely to have a greater effect on growth than expense, while its negative effect on the Gini coefficient is either insignificant or transient, just like expense.

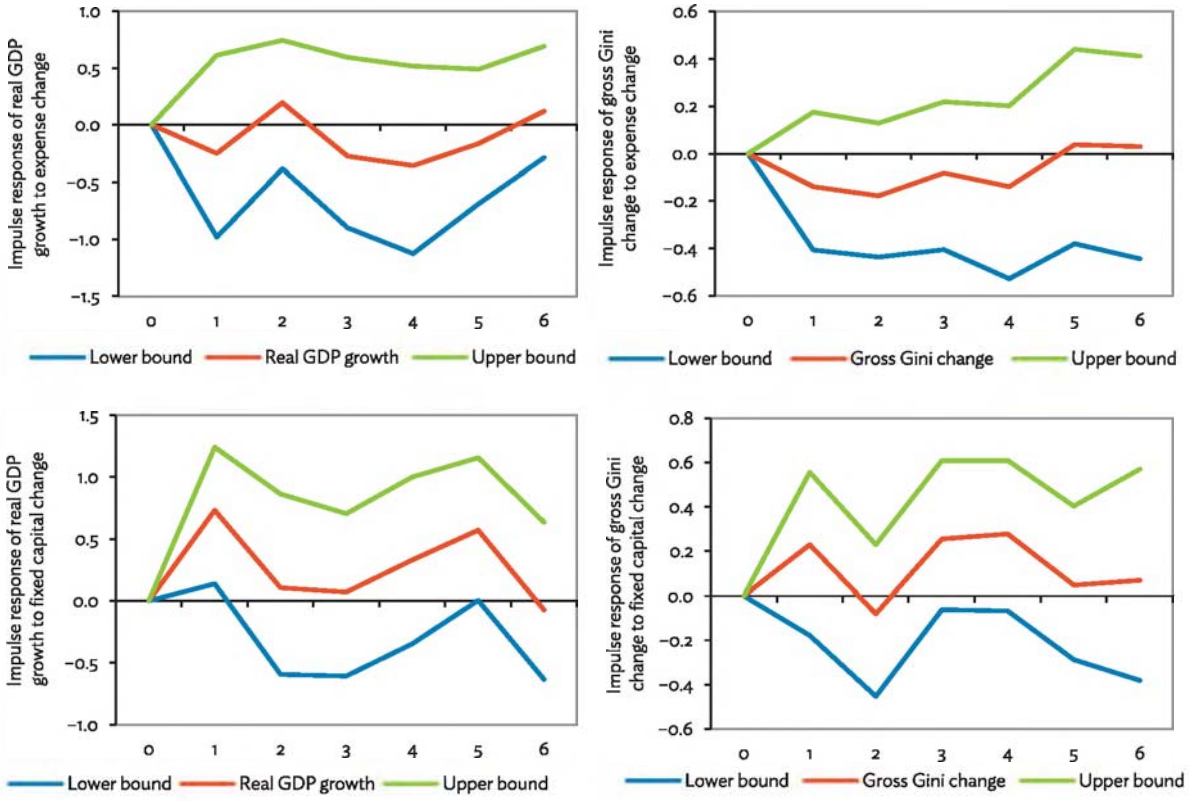
Figure 7: Four-Variable Panel Vector Autoregression for Changes in Expense and Public Health Spending



GDP = gross domestic product, gross Gini change = change in Gini before taxation and transfers.
Source: Author's estimates.

Third, according to Figure 8, public gross fixed capital formation seems to have a significant positive effect on economic growth in the first year, while expense does not make any visible contributions to growth. However, neither has a significant effect on the Gini coefficient.

Figure 8: Four-Variable Panel Vector Autoregression for Changes in Expense and Public Gross Fixed Capital Formation



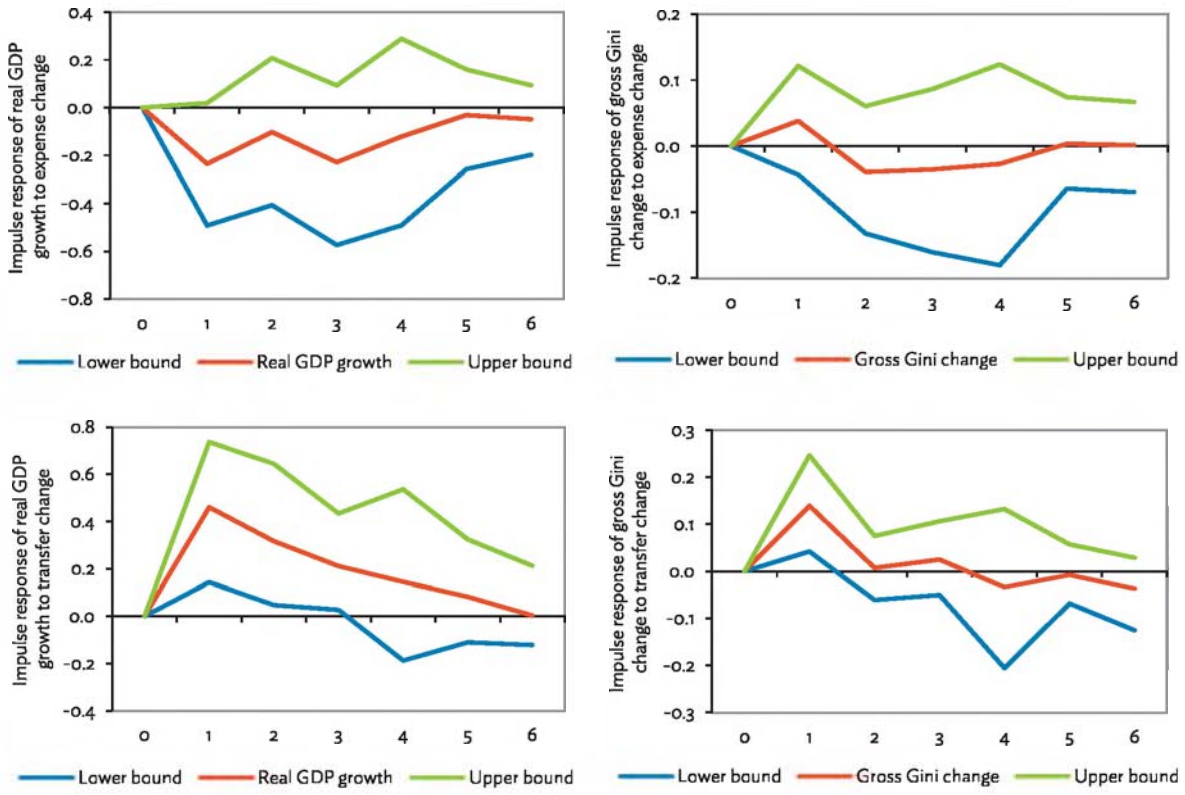
GDP = gross domestic product, gross Gini change = change in Gini before taxation and transfers.
Source: Author's estimates.

Fourth, the effects from a change in social subsidies and transfers are quite similar to public health expenditure and public education spending (Figure 9). Social subsidies and transfers seem to have persistent and positive effects on GDP growth, whereas they are likely to raise the Gini coefficient temporarily. This result is qualitatively the same as in the corresponding three-variable PVAR estimation.

The results of the four-variable PVARs are quite appealing in that gross fixed capital formation as well as public health spending, education spending, and social subsidies and transfers have significant positive effects on economic growth, even temporarily. However, they still do not give a definitive answer on the effects of these items on income inequality. Some expenditures naturally tend to have a significant effect on the Gini coefficient, but even so, the effects turn out to be short- lived or positive, which is contrary to expectations.[11]

[11] Based on the existing literature, Cournède, Goujard, and Pina (2013) conjecture that education and health spending would reduce income inequality.

Figure 9: Four-Variable Panel Vector Autoregression for Changes in Expense and Social Subsidies and Transfers



GDP = gross domestic product, gross Gini change = change in Gini before taxation and transfers.

Source: Author's estimates.

In this regard, I suspect two possibilities. The first one is that the distribution effects of fiscal spending items may accrue either contemporaneously or over the long term. For example, social subsidies and transfers or progressive income taxation have direct effects on income inequality. In contrast, public spending on education contributes to the income growth of a recipient only when he or she finishes school and earns income. Considering that it usually takes longer than 10 years to graduate from secondary educational institutions, the effect of public spending on education can be assessed over a decade or so. As previously stated, I chose the Gini_gross (Gini_market) coefficient in order to exclude contemporaneous effects. Furthermore, the current PVAR setup of yearly frequency does not allow a time frame long enough to observe the long-run effects of fiscal spending items on the Gini coefficients. In this context, I focus on measuring long-term effects using simple correlations between fiscal spending items and the Gini coefficient with lags. This issue will be covered in Section IV.C.

The second possibility is that the PVAR setup and the variables included may not represent the uniqueness of the situation in which each economy is positioned. OLS and panel regressions with control variables could complement PVAR in this aspect. The results from running OLS and panel regression are provided and interpreted in Section IV.B. I divided the data set into the two groups (ADB members and the OECD members) and ran four-variable PVAR separately in Section IV.A.2.

2. Results from Panel Vector Autoregression Estimations by Groups

The results are summarized in Figures 10, 11, and 12. Compared with using whole samples, I noticed that the growth effects of public health spending, public education spending, and social subsidies and transfers[12] were greater for the OECD members. In contrast, increases in public health and public education spending seemed to alleviate income inequality significantly in ADB members, which is not supported in the previous PVAR estimation. Although insignificant, the IRF of the Gini_gross coefficient to transfers is lower for ADB members than for the OECD members (Figure 12).

These results are consistent with the reality in which developing economies allocate smaller portions of fiscal resources to health and education. Low-income households tend to have greater demand for public health and education, and appreciate even a small increase in the shares of these fiscal spending items. Hence, positive distribution effects are more expected in developing economies.

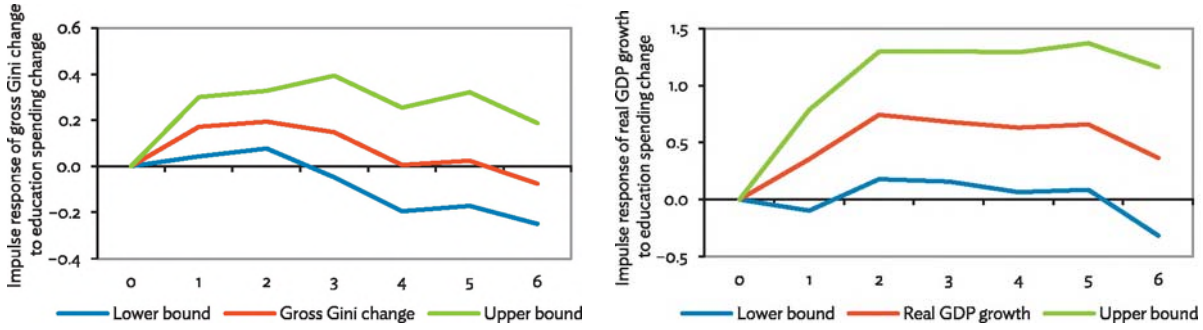
Figure 10: Four-Variable Panel Vector Autoregression for Changes in Expense and Public Health Spending

GDP = gross domestic product, gross Gini change = change in Gini before taxation and transfers.
Source: Author's estimates.

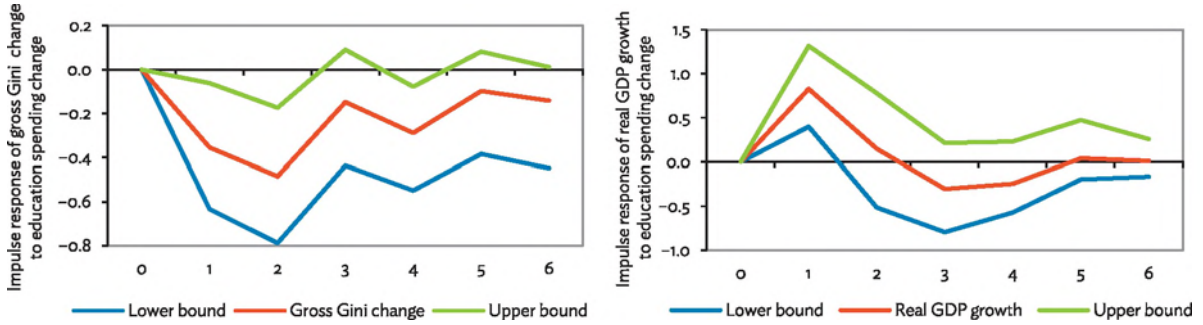
[12] The impulse responses of public gross fixed capital formation are not compared here due to data problems. In the WDI data set, gross fixed capital formation is available only for ADB members, whereas public health spending, education spending, and transfers and social subsidies include observations from both the OECD and ADB members.

Figure 11: Four-Variable Panel Vector Autoregression for Changes in Expense and Public Education Spending

A. Organisation for Economic Co-operation and Development Members



B. Asian Development Bank Members



GDP = gross domestic product., gross Gini change = change in Gini before taxation and transfers.
Source: Author's estimates.

Figure 12: Four-Variable Panel Vector Autoregression for Changes in Expense and Transfers

gross Gini change = change in Gini before taxation and transfers.
Source: Author's estimates.

3. Comparisons [13]

In this section the PVAR results from using the whole economy samples are compared with those from ADB and the OECD groups. To begin with, I report the sums of the impulse responses separately for ADB and the OECD members.

[13] Note that numbers in the tables of this section answer either of the following questions: (1) If the share of a certain expenditure item to GDP increases by 1 percentage point, what percentage of GDP will grow in response in the next 7 years? (2) If the share of a certain expenditure item to GDP increases by 1 percentage point, how much will Gini_gross (0~100 scale) grow in response in the next 7 years?

Table 3: Estimates of Cumulative Impulse Responses over the Next 7 Years
(All responses included)

Gini_gross	health_change	edu_change	transfer_change
ADB	−1.004	−1.518	−0.735
OECD	−0.010	0.466	0.438

GDP growth	health_change	edu_change	transfer_change
ADB	0.109	0.476	−0.343
OECD	1.924	3.424	2.238

ADB = Asian Development Bank, edu_change = change in public education spending, GDP = gross domestic product, Gini_gross = Gini before taxation and transfers, health_change = change in public health spending, OECD = Organisation for Economic Co-operation and Development, transfer_change = change in social subsidies and transfers.
Note: ADB covers 33 of its 48 members, while the OECD has its 34 members.
Source: Author's estimates.

The numbers in Table 3 are both significant and insignificant and thus tend to exaggerate effects. In contrast, Table 4 reports rather conservative estimates by summing only significant impulse responses.

Table 4: Estimates of Cumulative Impulse Responses over the Next 7 Years
(Significant responses only)

Gini_gross	health_change	edu_change	transfer_change
ADB	−0.288	−1.13	−0.600
OECD	0.000	0.363	0.141

GDP growth	health_change	edu_change	transfer_change
ADB	0.000	0.827	0.000
OECD	0.338	2.708	1.776

ADB = Asian Development Bank, edu_change = change in public education spending, GDP = gross domestic product, Gini_gross = Gini before taxation and transfers, health_change = change in public health spending, OECD = Organisation for Economic Co-operation and Development, transfer_change = change in social subsidies and transfers.
Note: ADB covers 33 of its 48 members, while the OECD has its 34 members.
Source: Author's estimates.

Tables 5 and 6 report the sums of the estimated impulse responses for the whole economy.

Table 5: Estimates of Cumulative Impulse Responses over the Next 7 Years
(Whole economy, all responses included)

	health_change	edu_change	cap_change[a]	transfer_change
GDP growth	1.760	2.204	1.735	1.217
Gini_gross	−0.198	−0.011	0.799	0.093

cap_change = change in gross fixed capital formation, public; edu_change = change in public education spending; GDP = gross domestic product; Gini_gross = Gini before taxation and transfers; health_change = change in public health spending; transfer_change = change in social subsidies and transfers.
[a] Can be compared with Asian Development Bank results in Tables 3 and 4.
Source: Author's estimates.

Table 6: Estimates of Cumulative Impulse Responses over the Next 7 Years
(Whole economy, significant responses only)

	health_change	edu_change	cap_change[a]	transfer_change
GDP growth	1.428	1.597	1.302	0.986
Gini_gross	−0.059	0.164	0.000	0.139

cap_change = change in gross fixed capital formation, public; edu_change = change in public education spending; GDP = gross domestic product; Gini_gross = Gini before taxation and transfers; health_change = change in public health spending; transfer_change = change in social subsidies and transfers.
[a] Can be compared with Asian Development Bank results in Tables 3 and 4.
Source: Author's estimates.

Compared with public health and education spending, the effect of gross fixed capital formation on GDP growth seems slightly smaller. However, in the WDI data, gross fixed capital formation is available only for ADB members, whereas public health and education spending include both ADB and the OECD members. Considering this limitation, the numbers marked with an "a" in the tables could be compared with the numbers for ADB members in Tables 3 and 4.

Table 7: Estimates of Cumulative Impulse Responses over the Next 7 Years
(All responses included)

	health_change	edu_change	cap_change	trans_change
GDP growth	0.109	0.476	1.735[a]	−0.343
Gini_gross	−1.004	−1.518	0.799	−0.735

cap_change = change in gross fixed capital formation, public; edu_change = change in public education spending; GDP = gross domestic product; Gini_gross = Gini before taxation and transfers; health_change = change in public health spending; transfer_change = change in social subsidies and transfers.
[a] Can be compared with Asian Development Bank results in Tables 3 and 4.
Source: Author's estimates.

Table 8: Estimates of Cumulative Impulse Responses over the Next 7 Years
(Significant responses only)

	health_change	edu_change	cap_change	trans_change
GDP growth	0.000	0.827	1.302[a]	0.000
Gini_gross	−0.288	−1.130	0.000	−0.600

cap_change = change in gross fixed capital formation, public; edu_change = change in public education spending; GDP = gross domestic product; Gini_gross = Gini before taxation and transfers; health_change = change in public health spending; transfer_change = change in social subsidies and transfers.
[a] Can be compared with Asian Development Bank results in Tables 3 and 4.
Source: Author's estimates.

Summarizing Tables 7 and 8, gross fixed capital formation seems to have a greater positive effect on economic growth in ADB members than other fiscal spending items. On the other hand, its negative impact on the Gini coefficient can be diluted by increasing spending on other items, such as health and education. In this regard, gross fixed capital formation, and public health and education spending complement each other in pursuing inclusive growth policies, at least in developing countries.

B. Results from the Single Equation Approach

The single equation approach is complementary to PVAR in that it is easy to implement and allows the free inclusion of control variables. On the other hand, it requires extra caution to eliminate endogeneity or misspecification from which PVAR is relatively free. The results were obtained by using observations from 164 countries. The extension of the data set was somewhat necessary to prevent sample losses that might occur as more variables were added.

Tables 9–13 were obtained from running a pooled regression. Tables 10 and 13 differ from the rest in that they use one period–lagged variables for regressors in order to avoid endogeneity. Unlike PVAR, OLS allow not only control variables but also any number of fiscal expenditure items. In order to exploit the advantage of OLS, I included as many fiscal spending items as possible in the regression.

Table 9 shows consistently that public gross fixed capital investment contributes to growth better than any other fiscal spending item; however, that significant contribution disappears when all the regressors are lagged by one period (Table 10).

Table 9: Real Gross Domestic Product Growth and Fiscal Expenditure Items
(Pooled regression)

	r_gdp_growth			
Variables	(1)	(2)	(3)	(4)
health_exp	−1.091***	−0.792***	−0.224	
	(0.346)	(0.296)	(0.181)	
edu_exp	0.454*	0.171		
	(0.260)	(0.218)		
cap_exp	0.236**	0.222**	0.210***	0.148**
	(0.110)	(0.101)	(0.0723)	(0.0656)
transfer_exp	0.000456			
	(0.00106)			

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Table 9 continued

	r_gdp_growth			
Variables	(1)	(2)	(3)	(4)
expense	−0.0791			
	(0.101)			
fiscal_surplus	0.436***	0.425***	0.315***	0.345***
	(0.107)	(0.104)	(0.0753)	(0.0641)
fiscal_debt	−0.0148	−0.0246**	−0.0191***	−0.0178***
	(0.0121)	(0.0103)	(0.00643)	(0.00590)
OECD member	4.804**	0.875	0.581	0.789
	(2.079)	(1.458)	(1.075)	(1.023)
ADB member	−0.132	0.478	1.515***	2.477***
	(0.738)	(0.700)	(0.530)	(0.474)
Constant	7.503***	6.758***	5.258***	4.115***
	(1.455)	(1.254)	(0.779)	(0.502)
Observations	195	211	332	427
R-squared	0.216	0.186	0.162	0.181

ADB = Asian Development Bank; cap_exp = gross fixed capital formation, public (% of GDP); edu_exp = public spending on education (% of GDP); expense = expense (% of GDP); fiscal_debt = central government debt, total (% of GDP); fiscal_surplus = cash surplus/deficit (% of GDP); health_exp = health expenditure, public (% of GDP); OECD = Organisation for Economic Co-operation and Development; r_gdp_growth = real gross domestic product growth; transfer_exp = subsidies and other transfers (% of GDP).
Notes: Standard errors are in parentheses; *** p<0.01, ** p<0.05, * p<0.1.
Source: Author's estimates.

Table 10: Real Gross Domestic Product Growth and Lagged Fiscal Expenditure Items (Pooled regression)

	r_gdp_growth			
VARIABLES	(1)	(2)	(3)	(4)
health_exp (−1)	−0.473	−0.417	−0.0923	
	(0.371)	(0.352)	(0.211)	
edu_exp (−1)	0.231	0.287		
	(0.279)	(0.254)		
cap_exp (−1)	0.122	0.135	0.192**	0.0795
	(0.118)	(0.115)	(0.0820)	(0.0711)
transfer_exp (−1)	0.00101	0.00141*	0.000333	0.000522
	(0.00114)	(0.000799)	(0.000508)	(0.000447)
expense (−1)	0.0534			
	(0.109)			
fiscal_surplus (−1)	0.167	0.156	0.110	0.195***
	(0.115)	(0.113)	(0.0789)	(0.0677)
fiscal_debt (−1)	−0.000279	0.00117	−0.00406	−0.000382
	(0.0130)	(0.0126)	(0.00736)	(0.00706)
OECD member	2.259	2.351	0.979	1.342
	(2.232)	(2.219)	(1.402)	(1.507)
ADB member	2.006**	1.929**	1.583***	2.618***
	(0.792)	(0.775)	(0.565)	(0.521)
Constant	2.170	2.426	3.740***	3.067***
	(1.562)	(1.469)	(0.945)	(0.807)
Observations	195	195	311	392
R-squared	0.088	0.087	0.070	0.090

ADB = Asian Development Bank; cap_exp = gross fixed capital formation, public (% of GDP); edu_exp = public spending on education (% of GDP); expense = expense (% of GDP); fiscal_debt = central government debt, total (% of GDP); fiscal_surplus = cash surplus/deficit (% of GDP); health_exp = health expenditure, public (% of GDP); OECD = Organisation for Economic Co-operation and Development; r_gdp_growth = real gross domestic product growth; transfer_exp = subsidies and other transfers (% of GDP).
Notes: Standard errors are in parentheses; *** p<0.01, ** p<0.05, * p<0.1.
Source: Author's estimates.

As for the distributional effect of fiscal expenditure items, social subsidies and transfers (transfer_exp) seem to significantly reduce income inequality regardless of inequality measures. Table 11 is based on the Gini_gross coefficients while Table 12 uses the Gini_net coefficients. In both cases, the coefficients to transfer_exp turn out to be significantly negative.

Table 13 estimates the contribution of each fiscal expenditure item on income inequality using one period lagged explanatory variables, and it still confirms that social subsidies and transfers (transfer_exp) reduce income inequality significantly.

Table 11: Gini_Gross Coefficient and Fiscal Expenditure Items
(Pooled regression)

Variables	Gini_gross			
	(1)	(2)	(3)	(4)
health_exp	0.559	0.581	0.626**	−0.158**
	(0.674)	(0.620)	(0.254)	(0.066)
edu_exp	−0.433	−0.419	−0.305	
	(0.446)	(0.412)	(0.228)	
cap_exp	0.104	0.108		
	(0.202)	(0.197)		
transfer_exp	−0.0039**	−0.0038***	−0.0013***	−0.002***
	(0.002)	(0.001)	(0.000)	(0.000)
expense	0.0155			
	(0.187)			
fiscal_surplus	−0.0790	−0.0837	−0.158**	−0.170***
	(0.199)	(0.190)	(0.066)	(0.057)
fiscal_debt	−0.0190	−0.0187	0.000900	0.00377
	(0.0217)	(0.0212)	(0.008)	(0.007)
OECD member	−0.391	−0.368	−1.587*	−1.183
	(3.528)	(3.506)	(0.926)	(0.820)
ADB member	0.964	0.942	2.260**	2.728***
	(1.343)	(1.312)	(0.882)	(0.752)
Constant	46.46***	46.54***	43.79***	44.50***
	(2.729)	(2.558)	(1.224)	(0.878)
Observations	177	177	536	782
R-squared	0.115	0.115	0.077	0.121

ADB = Asian Development Bank; cap_exp = gross fixed capital formation, public (% of GDP); edu_exp = public spending on education (% of GDP); expense = expense (% of GDP); fiscal_debt = central government debt, total (% of GDP); fiscal_surplus = cash surplus/deficit (% of GDP); gini_gross = Gini before taxation and transfers; health_exp = health expenditure, public (% of GDP); OECD = Organisation for Economic Co-operation and Development; transfer_exp = subsidies and other transfers (% of GDP).
Notes: Standard errors are in parentheses; *** p<0.01, ** p<0.05, * p<0.1.
Source: Author's estimates.

Table 12: Gini_Net Coefficient and Fiscal Expenditure Items
(Pooled regression)

Variables	Gini_net			
	(1)	(2)	(3)	(4)
health_exp	0.656	−0.126	−0.126	
	(0.650)	(0.226)	(0.226)	
edu_exp	−0.353	−0.908***	−0.898***	−0.927***
	(0.430)	(0.213)	(0.203)	(0.174)
cap_exp	0.0324			
	(0.194)			
transfer_exp	−0.00788***	−0.00340***	−0.00334***	−0.00341***
	(0.00180)	(0.000503)	(0.000357)	(0.000356)

continued on next page

Table 12 continued

Variables	Gini_net (1)	(2)	(3)	(4)
expense	0.163	0.00665		
	(0.180)	(0.0434)		
fiscal_surplus	−0.0387	−0.234***	−0.236***	−0.139**
	(0.192)	(0.0608)	(0.0591)	(0.0579)
fiscal_debt	−0.0161	0.00661	0.00709	0.00837
	(0.0209)	(0.00815)	(0.00751)	(0.00748)
OECD member	−3.564	−5.966***	−5.964***	−6.688***
	(3.400)	(0.825)	(0.824)	(0.639)
ADB member	2.479*	1.393*	1.376*	0.832
	(1.294)	(0.793)	(0.785)	(0.713)
Constant	43.24***	47.23***	47.27***	47.39***
	(2.630)	(1.110)	(1.089)	(1.027)
Observations	177	536	536	589
R-squared	0.312	0.630	0.630	0.617

ADB = Asian Development Bank; cap_exp = gross fixed capital formation, public (% of GDP); edu_exp = public spending on education (% of GDP); expense = expense (% of GDP); fiscal_debt = Central Government debt, total (% of GDP); fiscal_surplus = cash surplus/deficit (% of GDP); gini_net = Gini after taxation and transfers; health_exp = health expenditure, public (% of GDP); OECD = Organisation for Economic Co-operation and Development; transfer_exp = subsidies and other transfers (% of GDP).
Notes: Standard errors are in parentheses; *** p<0.01, ** p<0.05, * p<0.1.
Source: Author's estimates.

Table 13: Gini Coefficients and Lagged Fiscal Expenditure Items
(Pooled regression)

Variables	Gini_gross (1)	Gini_net (2)
health_exp (−1)	0.503	0.518
	(0.691)	(0.652)
edu_exp (−1)	−0.558	−0.550
	(0.471)	(0.444)
cap_exp (−1)	0.123	0.0661
	(0.211)	(0.199)
transfer_exp (−1)	−0.00347*	−0.00779***
	(0.00198)	(0.00186)
expense (−1)	0.0528	0.231
	(0.199)	(0.187)
fiscal_surplus (−1)	0.0156	0.0468
	(0.211)	(0.199)
fiscal_debt (−1)	−0.0170	−0.0192
	(0.0228)	(0.0215)
OECD member	−1.613	−4.670
	(3.598)	(3.395)
ADB member	0.698	2.073
	(1.417)	(1.337)
Constant	45.65***	42.75***
	(2.926)	(2.761)
Observations	166	166
R-squared	0.091	0.297

ADB = Asian Development Bank; cap_exp = gross fixed capital formation, public (% of GDP); edu_exp = public spending on education (% of GDP); expense = expense (% of GDP); fiscal_debt = central government debt, total (% of GDP); fiscal_surplus = cash surplus/deficit (% of GDP); gini_gross = Gini before taxation and transfers; gini_net = Gini after taxation and transfers; health_exp = health expenditure, public (% of GDP); OECD = Organisation for Economic Co-operation and Development; transfer_exp = subsidies and other transfers (% of GDP).
Notes: Standard errors are in parentheses; *** p<0.01, ** p<0.05, * p<0.1.
Source: Author's estimates.

The results from the dynamic panel regression are reported in Tables 14 and 15. Table 14 confirms that public education spending contributes the most to real GDP growth. In contrast, according to Table 15, there is no significant fiscal expenditure item that affects the Gini coefficient.

Table 14: Real Gross Domestic Product Growth and Lagged Fiscal Expenditure Items
(Dynamic panel regression)

	r_gdp_growth		
Variables	(1)	(2)	(3)
r_gdp_growth (–1)	0.0475	0.0511	0.0516
	(0.0998)	(0.0951)	(0.0521)
r_gdp_growth (–2)	–0.219**	–0.214**	–0.281***
	(0.0962)	(0.0928)	(0.0502)
health_exp (–1)	–3.025**	–2.183*	–1.091***
	(1.371)	(1.298)	(0.350)
edu_exp (–1)	1.509*	1.201	1.131**
	(0.859)	(0.770)	(0.462)
cap_exp (–1)	–0.213	0.0967	
	(0.309)	(0.254)	
transfer_exp (–1)	0.000171		
	(0.00390)		
expense (–1)	0.161		
	(0.270)		
fiscal_surplus (–1)	0.122	0.0238	0.144
	(0.262)	(0.241)	(0.0914)
fiscal_debt (–1)	0.0869**	0.0627	0.0348*
	(0.0421)	(0.0383)	(0.0181)
Constant	1.990	3.457	2.223
	(6.063)	(5.306)	(2.864)
Observations	122	135	439
Number of economies	35	38	72

cap_exp = gross fixed capital formation, public (% of GDP); edu_exp = public spending on education (% of GDP); expense = expense (% of GDP); fiscal_debt = Central Government debt, total (% of GDP); fiscal_surplus = cash surplus/deficit (% of GDP); health_exp = health expenditure, public (% of GDP); r_gdp_growth = real gross domestic product growth; transfer_exp = subsidies and other transfers (% of GDP).
Notes: Standard errors are in parentheses; *** p<0.01, ** p<0.05, * p<0.1.
Source: Author's estimates.

Table 15: Gini Coefficient and Lagged Fiscal Expenditure Items
(Dynamic panel regression)

	Gini_gross			
Variables	(1)	(2)	(3)	(4)
gini_market (–1)	0.501***	0.789***	0.798***	0.779***
	(0.0908)	(0.0447)	(0.0436)	(0.0409)
gini_market (–2)	0.189*	–0.147***	–0.150***	–0.115***
	(0.104)	(0.0411)	(0.0404)	(0.0382)
health_exp (–1)	–0.384	0.107	0.117	
	(0.389)	(0.102)	(0.100)	
edu_exp (–1)	–0.396	–0.215	–0.274*	–0.221
	(0.261)	(0.155)	(0.150)	(0.138)
cap_exp (–1)	–0.0900			
	(0.0972)			
transfer_exp (–1)	–0.00173	–5.70e-06		
	(0.00123)	(0.000273)		

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Table 15 continued

Variables	Gini_gross			
	(1)	(2)	(3)	(4)
expense (–1)	0.203**	0.0466**	0.0447**	0.0457**
	(0.0840)	(0.0228)	(0.0184)	(0.0181)
fiscal_surplus (–1)	–0.113	–0.0733***	–0.0770***	–0.0872***
	(0.0803)	(0.0277)	(0.0274)	(0.0248)
fiscal_debt (–1)	–0.00894	–0.0333***	–0.0323***	–0.0335***
	(0.0118)	(0.00614)	(0.00573)	(0.00553)
Constant	13.73***	16.13***	16.21***	15.86***
	(4.118)	(1.309)	(1.292)	(1.206)
Observations	103	396	409	452
Number of economies	32	64	67	72

cap_exp = gross fixed capital formation, public (% of GDP); edu_exp = public spending on education (% of GDP); expense = expense (% of GDP); fiscal_debt = central government debt, total (% of GDP); fiscal_surplus = cash surplus/deficit (% of GDP); gini_gross (or gini_market) = Gini before taxation and transfers; gini_net = Gini after taxation and transfers; health_exp = health expenditure, public (% of GDP); transfer_exp = subsidies and other transfers (% of GDP).
Notes: Standard errors are in parentheses; *** p<0.01, ** p<0.05, * p<0.1.
Source: Author's estimates.

C. Long-Term Relationships Among Key Variables

In this section I measure the long-run effects of itemized fiscal spending on growth and income inequality using simple correlations. First, I calculated correlations with 10-year lags. In the upper half of Table 16, no fiscal spending items (in differences) have significant positive effects on real GDP growth. On the other hand, with the exceptions of public gross capital formation and military spending, all fiscal expenditure items have negative and significant effects on the Gini_gross (Gini_market) coefficient and are thus likely to reduce income inequality.

Next, I get the bottom half of Table 16 by taking 10-year averages of the variables for the 1990s and 2000s. The results confirm the effect of fiscal spending items on the Gini coefficient again but with a low significance level. However, correlations with real GDP growth become negative, except for public gross capital formation and military spending (in differences). By construction, the 2- period panel data in the bottom half take an average lag of 5 years. I suspect that the time frame of 5 years may not be long enough to see the long-run effect accrue and the short-run effect dissipate.

Table 16: Correlations Between Key Variables and Their Notations

Spending Items (t years)	Real GDP growth (t+10 years)	Gini_market (t+10 years)
edu_exp	0.012 (0.745)	–0.083**(0.013)
cap_exp	–0.030 (0.559)	0.165***(0.002)
health_exp	–0.010(0.841)	–0.152***(0.003)
transfer_exp	0.016 (0.779)	–0.289*** (0.000)
mil_exp	–0.043 (0.246)	0.043 (0.256)
gfce	–0.019 (0.402)	–0.172***(0.000)

continued on next page

Table 16 continued

Spending Items (during 1990~1999)	Real GDP growth (during 2000~2010)	Gini_market (during 2000~2010)
edu_exp	−0.538***(0.000)	−0.196+(0.155)
cap_exp	0.082 (0.718)	0.276(0.215)
health_exp	−0.672*** (0.000)	−0.198+(0.125)
transfer_exp	−0.721*** (0.000)	−0.308* (0.053)
mil_exp	0.154 (0.248)	0.066 (0.624)
gfce	−0.382 ***(0.002)	−0.256 **(0.045)

cap_exp = gross fixed capital formation, public (% of GDP); edu_exp = public spending on education (% of GDP); GDP = gross domestic product; gfce = government financial consumption expenditures (% of GDP); Gini_market = Gini before taxation and transfers; health_exp = health expenditure, public (% of GDP); transfer_exp = subsidies and other transfers (% of GDP).
Notes: The numbers in ( ) are significance levels of the correlation coefficients. *** p<0.01, ** p<0.05, * p<0.1, and + p<0.15.
Source: Author's estimates.

Summing up, there are significant long-term correlations between lagged fiscal spending items and the current Gini coefficient. In contrast, any correlation with real GDP growth is insignificant. Combined with the results from the previous sections, Table 16 indicates that the contribution of individual spending items to economic growth and income inequality should be measured over different time frames.

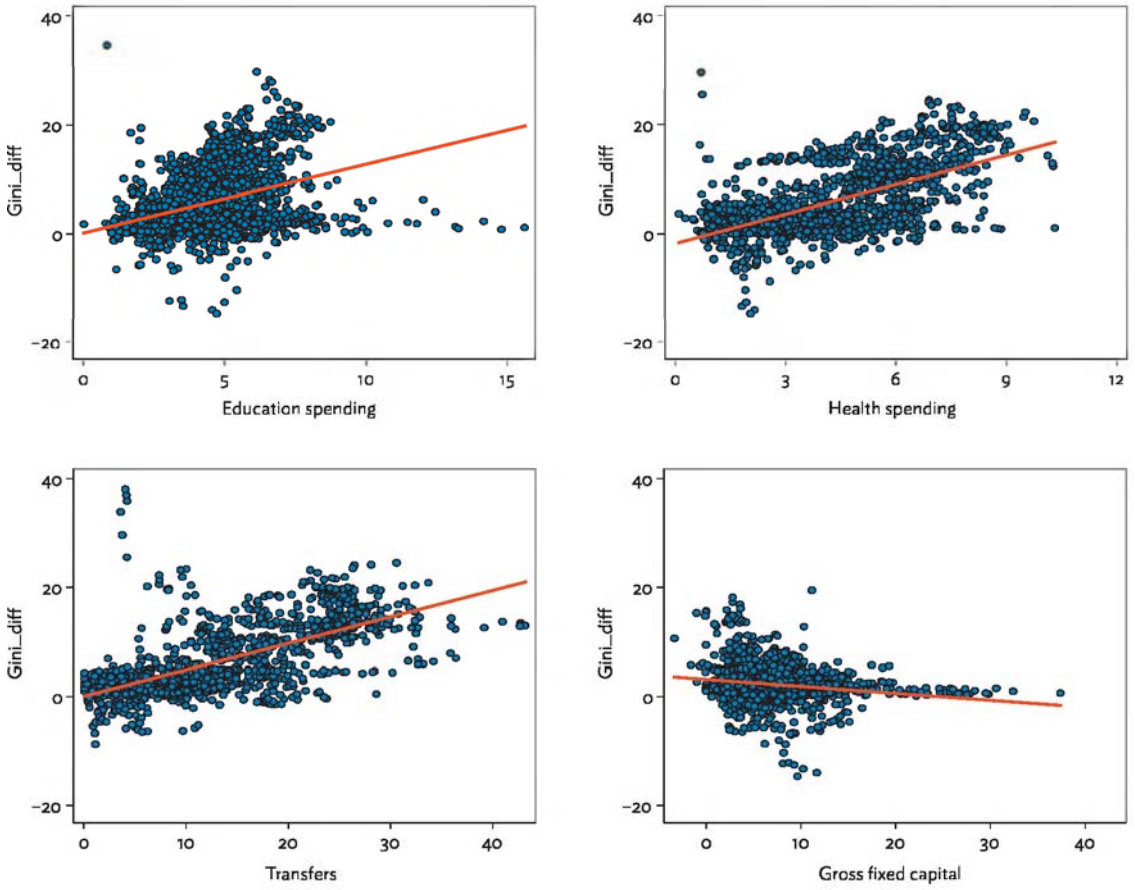
D. Contemporaneous Relationships Among Key Variables

The VAR, by construction, is useful for evaluating contemporaneous effects among endogenous variables depending on shock identification strategies. However, contemporaneous effects on income inequality cannot be precisely estimated by PVAR because the Gini_gross coefficients are used. Hence, in this section, I estimate the contemporaneous effects of fiscal composition on income inequality separately.

1. Difference Between Gini_gross and Gini_net

First, I define Gini_diff to be Gini_gross minus (−) Gini_net. Accordingly, the greater the Gini_diff is, the more redistributive the fiscal system is. The scatter plots in Figure 13 exhibit the relationships between the Gini_diff and various components of fiscal expenditure. Keeping in mind that these scatter plots detect contemporaneous relationships between any pair of variables, we see that all the fiscal spending components tend to work for redistribution, with the exception of public gross capital formation.

Figure 13: Gini_diff and Government Expense
(% of GDP)



GDP = gross domestic product, Gini_diff = difference between Gini_gross (Gini before taxation and transfers) and Gini_net (Gini after taxation and transfers).
Source: Author's estimates.

The subplots in Figure 13 are regressed on various fiscal expenditure items. For a dependent variable, Gini_diff (Gini_gross–Gini_net) is used, and the estimated slope coefficients measure the contemporaneous effects of fiscal spending items on economic inequality. Here the positive coefficients indicate that the corresponding fiscal expenditure items tend to alleviate economic inequality.

2. The Poverty Gap at the National Poverty Line

As mentioned previously, the poverty gap is not a precise measure for income inequality. The two are, however, closely related and complementary as proxies for social cohesion. Table 17 demonstrates that the poverty gap has significant and positive correlations with the two Gini coefficients, but the correlations are less than 1. Furthermore, some definitions of inclusive growth (Ranieri and Ramos 2013) include poverty reduction. In this context, I substituted poverty gap at the national poverty line (%) for the Gini_diff and examined its relationship with fiscal spending composition.

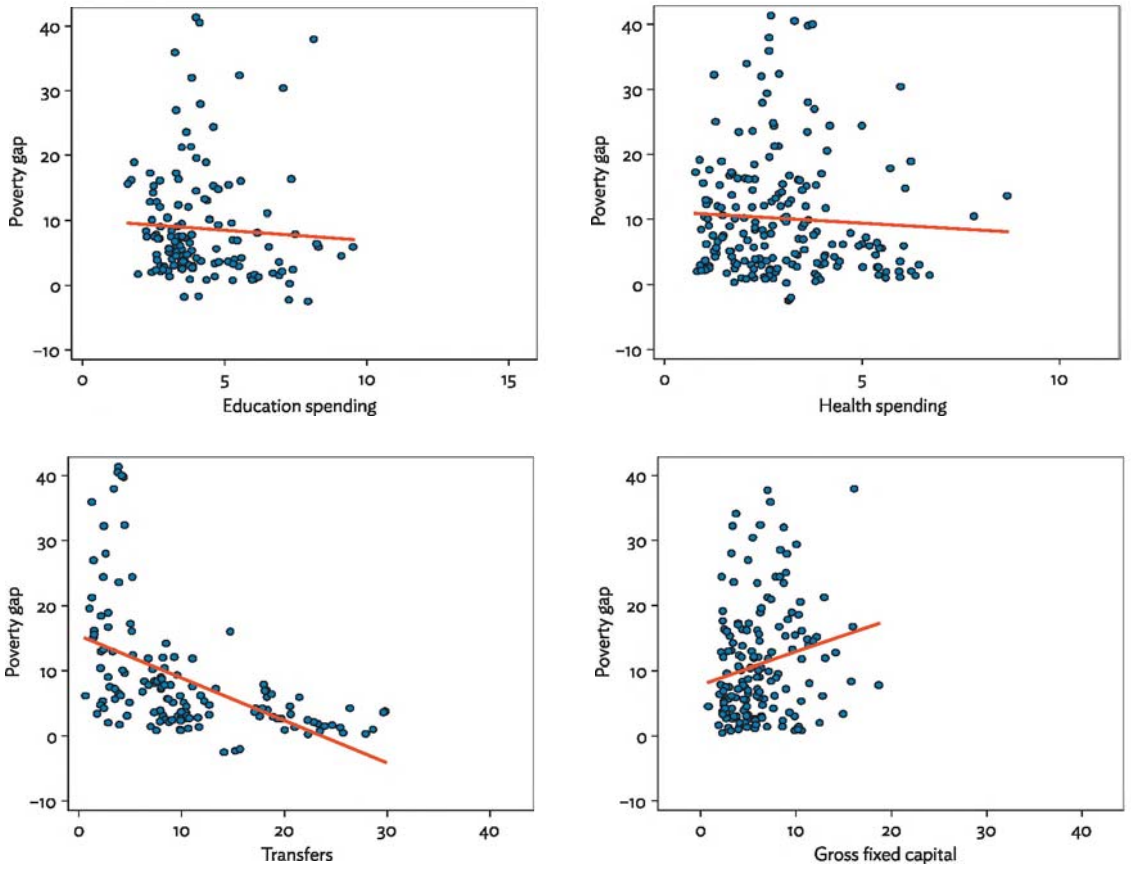
Table 17: Correlation of Poverty Gap with Gini Coefficients

Correlation with Gini Coefficients	Poverty Gap at the National Poverty Line (%)	Gini_net	Gini_market
Poverty gap at the national poverty line (%)	1.000		
Gini_net	0.441 (0.000)	1.000	
Gini_market	0.348 (0.000)	0.854 (0.000)	1.000

Gini_market = Gini before taxation and transfers, Gini_net = Gini after taxation and transfers.
Source: Author's estimates.

As with the Gini_diff, the scatter plots in Figure 14 show that all the fiscal spending components tend to work for redistribution, with the exception of public gross fixed capital formation.

Figure 14: Poverty Gap and Government Expense
(% of GDP)



GDP = gross domestic product.
Source: Author's estimates.

V. POLICY IMPLICATIONS

This paper examines the effects of fiscal policy on income inequality and growth with an emphasis on the composition of fiscal expenditure using cross-country panel data. The results were the following:

- Gross fixed capital formation, public health spending, and education spending have significant positive effects on economic growth.

- The positive effects of health and education spending on growth tend to be more persistent than those of gross fixed capital formation.

- The effects of fiscal spending items on the Gini coefficient are either temporarily positive or negligible in the annual frequency, with the exception of social subsidies and transfers.

- Compared with the OECD members, public health spending and public education spending seem to alleviate income inequality significantly. This implies that fiscal expenditure policy may contribute more to inclusive growth in developing economies than in advanced ones.

- The distributional effects of fiscal expenditure items occur in the long run. All the fiscal expenditure items have negative and significant effects on the Gini coefficient with the exceptions of public gross capital formation and military spending with 10 year lags. An examination of contemporaneous distribution effects confirms a similar pattern.

Based on these results, I recommend that the following should be implemented in creating fiscal expenditures for inclusive growth.

- Estimate multipliers of individual fiscal spending items using a time series of a single economy, then order them according to their magnitudes. This study uses a panel data set and cannot consider economy-specific factors thoroughly. For example, PVAR reflects the heterogeneity of each economy only by fixed effect and ignores differences in transmission channels across economies. In this respect, it would be more useful to use the time series data of a single economy to estimate various fiscal multipliers.[14] In the meantime, we should also be cautious about interpreting the results from the cross-country data and applying them to policy making.

- Reducing income inequality is not a goal that can be achieved in the short term. Hence, a solution is to increase the portion of fiscal spending items that have substantial direct effects on the Gini coefficient. Items such as social subsidies and transfers, and public health spending are known to have greater direct effects on alleviating income inequality. Another solution is to increase the size of a spending program that has greater potential to reduce inequality in the long run. Compared with the first option, the latter does not seem to be feasible in that the time frame of most politicians will definitely be shorter than a decade.

- In pursuing inclusive growth, coordination with tax policy is crucial. Matched with adjustments in the composition of fiscal spending, changes in the composition of various tax items could be considered and vice versa. In reality, however, spending is more flexible than taxation in most countries. Thus, adjustments in fiscal spending should be made after considering tax policies and

[14] In the case of SVAR, shock identification restrictions can vary depending on institutional arrangements as in Blanchard and Perotti (2002).

other social and macroeconomic needs. An approach by Cournède, Goujard, and Pina (2013) is a good example of how an understanding of the multipliers of various fiscal items over time can be applied to find an optimal mix of expenditures and tax revenues.

- Note that the government may replace the private sector in some fiscal spending areas. For example, spending on education and health, and public investment are shared by both entities, private and public. In other words, public spending in an area may crowd out (or crowd in, though this is less likely) its private counterpart. In the case of crowding out, expansionary fiscal spending could result in lower or ineffective fiscal multipliers. Crowding in is also a concern because it may lead to excessive government-supported resource allocations.

Table 18: Crowding Out versus Crowding In

Changes in the Share of Gross Fixed Capital Formation to GDP	Public Sector					
	Whole Sample (WDI)	Per Capita GDP Less than $5,000	Per Capita GDP Greater than $5,000	~1997	1998~2008	2008~
Private Sector	−0.1684*** (0.000)	−0.1675*** (0.000)	−0.2277* (0.062)	−0.1336*** (0.000)	−0.2026*** (0.000)	−0.3102*** (0.000)
Changes in the Share of Health Expenditure to GDP	**Public Sector**					
	Whole Sample (WDI)	**Per Capita GDP Less than $5,000**	**Per Capita GDP Greater than $5,000**	**~1997**	**1998~2008**	**2008~**
Private Sector	0.0874*** (0.000)	0.0857*** (0.000)	0.3513+ (0.1089)	0.3371*** (0.000)	0.0563** (0.018)	0.0734+ (0.1092)

GDP = gross domestic product, WDI = World Development Indicators.
Note: Correlations are calculated with the whole-country data in WDI.
Source: Author's estimates.

Table 18 confirms that crowding out is likely between public and private contributions in gross fixed capital formation, while in contrast, the public and private sectors appear complementary in health expenditure. Careful examination is thus required as part of "the science of delivery" to assess the consequences of crowding out or crowding in in every fiscal activity. Improving the delivery of public programs will help governments design fiscal programs so that both public and private spending may contribute to inclusive growth. Without an enhanced delivery system, increased fiscal activity cannot achieve what it is intended for. In this context, micro-level program evaluation could be useful.

- Fiscal programs with different targets and means can be compared in terms of both efficiency and equity; such an assessment, of course, should be based on a complete understanding of the entire delivery system of these programs. Program evaluation has been recently highlighted as a means for enhancing the efficiency of fiscal programs, mostly on the expenditure side. In principle, program evaluations should measure the effectiveness and the efficiency of any public program, and as with others, any fiscal program intended for inclusive growth should be assessed thoroughly.

  For this purpose, policy targets should be defined properly. For example, poverty, inequality, gender inequality, social protection, and basic social services are targets of inclusive growth

and are especially related to inclusiveness. On the other hand, barriers to investment and access to infrastructure are linked with economic growth. Productive employment serves both. Next, those targets should be matched with proper proxies. Finding a good proxy is key to program evaluation because selecting a bad proxy may lead to incorrect conclusions. Additionally, the proxies should take the form of indices because quantifiable indices allow the application of statistical methods in assessing the performance of individual programs.

- As mentioned previously, coordination with tax policy is critical in pursuing fiscal policies for inclusive growth, especially when the size of government debt matters. In this context, it would be worthwhile to discuss how public–private partnership (PPP) investments could replace fiscal resources and contribute to inclusive growth. Developing economies are likely to be constrained by narrow tax bases and low levels of capital accumulation, whereas they have higher demand for investment in social overhead capital. In this context, public–private infrastructure investment has been widely recommended. Investment in transportation infrastructure (road, railways, and ports); electricity networks (generation facilities, transmission and distribution systems); and water supply (drinking water and irrigation for agriculture) is a key determinant of economic growth. Furthermore, developing economies can get greater benefits from building social overhead capital, thanks to its higher rate of return. Therefore, financing such investments is considered to be a crucial condition for a developing economy in pursuing long-term growth. However, its domestic financial markets have yet to mature. They cannot afford the domestic demand for infrastructure investment without government guarantees. In these circumstances, PPPs allow a government to meet fiscal demands—especially for social overhead capital—by mobilizing private funds. That explains why public–private infrastructure investment attracts the attention of public officials in developing economies.

  Using PPPs cannot be limited to building social overhead capital. The results in previous sections confirm that public health and public education expenditures are more likely to alleviate income inequality in ADB members. What if a government were to allocate financial resources to these areas through PPPs instead of using tax money? Building new public schools and hospitals and installing proper equipment represents a substantial fiscal burden. It would be beneficial to mobilize private funds for these purposes.

  Still the question of whether private investors are willing to take on this role remains. In this sense, a key to successfully introducing PPPs in these areas lies in the profitability of the project and the assurance that private investors will be paid, as initially agreed. In practice, the government provides a certain form of payment guarantee (including minimum revenue guarantees) in order to attract private investors. Substantial guarantees, however, may become fiscal burdens. Thus, the government needs to restrict PPPs to areas with a certain level of profitability anticipated. For example, forecasting demand for local medical services is relatively easier with socioeconomic data, and the willingness to pay can also be calculated. Based on these estimates, the profitability of building a new hospital in a region can be assessed. In building infrastructure, demand forecast is affected by various factors, some of which are neither directly observable nor perceivable. Compared with social overhead capital, PPPs in health and education tend to be smaller and easier to implement. Their creative use in pursuing inclusive growth could lighten the public fiscal burden substantially.

APPENDIX: SUMMARY STATISTICS

Table A.1: All Economies

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
cap_exp	628	7.01	4.70	–1.58	38.57
edu_exp	1,373	4.50	1.64	0.00	11.90
expense	852	27.50	11.16	7.59	62.82
gfce	2,670	15.59	5.97	1.38	43.41
gini_gross	2,242	41.58	8.00	21.98	79.36
gini_net	2,242	34.28	9.97	15.71	80.41
global_equity_index	869	10.85	36.24	–78.76	254.50
gs_expense	836	4.04	3.01	0.95	25.87
health_exp	1,049	4.28	2.44	0.27	10.31
income_tax	898	6.85	4.36	0.26	22.15
life_exp	3,272	68.14	9.78	19.50	85.16
literacy	153	84.37	18.66	20.57	99.80
market_cap	1,221	60.88	67.81	0.04	606.00
mil_exp	1,347	2.20	1.67	0.13	17.96
primary_edu	659	29.58	17.21	0.00	80.40
r_gdp_growth	2,633	4.06	4.88	–44.90	42.41
revenue	899	25.96	10.57	2.94	51.12
secondary_edu	653	44.24	16.67	2.90	80.20
social_contribution	622	8.01	5.79	0.00	20.46
tax_revenue	900	16.87	6.43	2.50	35.78
tertiary_edu	659	23.67	9.78	2.10	57.10
transfer_exp	826	14.34	9.47	0.03	39.17
unemployment	1,324	6.89	4.13	0.10	36.40

cap_exp = gross fixed capital formation, public (% of GDP); edu_exp = public spending on education (% of GDP); expense = expense (% of GDP); gfce = government final consumption expenditures (% of GDP); gini_gross = Gini before taxation and transfers; gini_net = Gini after taxation and transfers; global_equity_index = S&P Global Equity Indices (annual % change); gs_expense = goods and services expense (% of GDP); health_exp = health expenditure, public (% of GDP); income_tax = taxes on income, profits, and capital gains (% of GDP); life_exp = life expectancy at birth, total (years); literacy = literacy rate, adult total (% of pop ages 15 and above); market_cap = market capitalization (% of GDP); mil_exp = military expenditure (% of GDP); primary_edu = labor force with primary education (% of total pop ages 15–64); r_gdp_growth = real GDP growth; revenue = revenue excluding grants (% of GDP); secondary_edu = labor force with secondary education (% of total population ages 15–64); social_contribution = social contributions (% of GDP); tax_revenue = tax revenue (% of GDP); tertiary_edu = labor force with tertiary education (% of total population ages 15–64); transfer_exp = subsidies and other transfers (% of GDP); unemployment = unemployment, total (%).
Source: Author's calculations based on the World Development Indicators online database (accessed 7 September 2013).

Table A2: Organisation for Economic Co-operation and Development Members

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
cap_exp	64	5.14	2.04	2.79	12.09
edu_exp	907	5.07	1.39	0.00	8.98
expense	492	34.57	8.87	13.35	62.82
gfce	1,563	17.92	5.32	5.64	43.41
gini_gross	1,340	40.36	6.44	22.83	65.79
gini_net	1,340	29.84	7.12	15.71	70.53
global_equity_index	646	10.25	33.10	−69.94	254.50
gs_expense	492	3.50	2.35	0.95	15.55
health_exp	561	6.10	1.55	1.94	10.27
income_tax	492	8.97	4.14	2.29	22.15
life_exp	1,712	73.81	4.94	45.38	85.16
literacy	57	92.91	7.97	61.63	99.80
market_cap	778	62.16	52.97	0.17	479.81
mil_exp	783	2.07	1.78	0.13	17.96
primary_edu	558	28.75	17.22	0.00	80.40
revenue	492	33.00	8.17	11.22	51.12
r_gdp_growth	1,480	3.24	3.41	−14.57	42.41
secondary_edu	552	45.72	16.16	2.90	80.20
social_contribution	469	10.19	4.94	0.02	20.46
tax_revenue	493	20.16	6.03	7.84	35.78
tertiary_edu	558	24.60	9.39	7.10	57.10
transfer_exp	481	20.84	6.71	6.18	39.17
unemployment	908	7.55	3.88	0.60	23.90

cap_exp = gross fixed capital formation, public (% of GDP); edu_exp = public spending on education (% of GDP); expense = expense (% of GDP); gfce = government final consumption expenditures (% of GDP); gini_gross = Gini before taxation and transfers; gini_net = Gini after taxation and transfers; global_equity_index = S&P Global Equity Indices (annual % change); gs_expense = goods and services expense (% of GDP); health_exp = health expenditure, public (% of GDP); income_tax = taxes on income, profits, and capital gains (% of GDP); life_exp = life expectancy at birth, total (years); literacy = literacy rate, adult total (% of pop ages 15 and above); market_cap = market capitalization (% of GDP); mil_exp = military expenditure (% of GDP); primary_edu = labor force with primary education (% of total pop ages 15–64); r_gdp_growth = real GDP growth; revenue = revenue excluding grants (% of GDP); secondary_edu = labor force with secondary education (% of total population ages 15–64); social_contribution = social contributions (% of GDP); tax_revenue = tax revenue (% of GDP); tertiary_edu = labor force with tertiary education (% of total population ages 15–64); transfer_exp = subsidies and other transfers (% of GDP); unemployment = unemployment, total (%).
Source: Author's calculations based on the World Development Indicators online database (accessed 7 September 2013).

Table A.3: Asian Development Bank Members

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
cap_exp	564	7.22	4.87	−1.58	38.57
edu_exp	466	3.41	1.52	0.83	11.90
expense	360	17.85	5.09	7.59	36.55
gfce	1,107	12.29	5.25	1.38	35.78
gini_gross	902	43.39	9.60	21.98	79.36
gini_net	902	40.87	9.95	18.76	80.41
global_equity_index	223	12.57	44.13	−78.76	147.18
gs_expense	344	4.81	3.63	1.13	25.87
health_exp	488	2.18	1.33	0.27	10.31
income_tax	406	4.29	3.04	0.26	14.49
life_exp	1,560	61.92	9.99	19.50	83.42
literacy	96	79.31	21.22	20.57	99.76
market_cap	443	58.63	88.04	0.04	606.00
mil_exp	564	2.38	1.49	0.23	9.36
primary_edu	101	34.21	16.47	2.90	68.70
revenue	407	17.45	5.81	2.94	37.69
r_gdp_growth	1,153	5.13	6.12	−44.90	35.38
secondary_edu	101	36.15	17.14	7.20	76.10
social_contribution	153	1.35	1.54	0.00	6.66
tax_revenue	407	12.87	4.27	2.50	28.71
tertiary_edu	101	18.51	10.33	2.10	50.00
transfer_exp	345	5.29	3.33	0.03	15.17
unemployment	416	5.46	4.31	0.10	36.40

cap_exp = gross fixed capital formation, public (% of GDP); edu_exp = public spending on education (% of GDP); expense = expense (% of GDP); gfce = government final consumption expenditures (% of GDP); gini_gross = Gini before taxation and transfers; gini_net = Gini after taxation and transfers; global_equity_index = S&P Global Equity Indices (annual % change); gs_expense = goods and services expense (% of GDP); health_exp = health expenditure, public (% of GDP); income_tax = taxes on income, profits, and capital gains (% of GDP); life_exp = life expectancy at birth, total (years); literacy = literacy rate, adult total (% of pop ages 15 and above); market_cap = market capitalization (% of GDP); mil_exp = military expenditure (% of GDP); primary_edu = labor force with primary education (% of total pop ages 15–64); r_gdp_growth = real GDP growth; revenue = revenue excluding grants (% of GDP); secondary_edu = labor force with secondary education (% of total population ages 15–64); social_contribution = social contributions (% of GDP); tax_revenue = tax revenue (% of GDP); tertiary_edu = labor force with tertiary education (% of total population ages 15–64); transfer_exp = subsidies and other transfers (% of GDP); unemployment = unemployment, total (%).
Source: Author's calculations based on the World Development Indicators online database (accessed 7 September 2013).

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Government Spending and Inclusive Growth in Developing Asia

This paper assesses the effects of fiscal policy on both equity and growth, specifically whether it is possible to design fiscal spending so that it enhances equity without sacrificing economic growth and vice versa. A cross-country panel vector autoregression (PVAR) confirms the growth effects of individual fiscal spending items as anticipated, whereas distributional effects were either temporarily positive or negligible for most fiscal items.

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